



T BRUCE APPELGATE JR PHD
ASSOCIATE DIRECTOR
SCRIPPS INSTITUTION OF OCEANOGRAPHY
9500 GILMAN DRIVE
LA JOLLA, CALIFORNIA 92093-0210

SHIP OPERATIONS AND MARINE TECHNICAL SUPPORT
EMAIL: TBA@UCSD.EDU
URL: SCRIPPS.UCSD.EDU/SHIPS
TEL: 858.534.2220

November 8, 2021

California Air Resources Control Board
P.O. Box 2815
Sacramento, CA 95812

Dear Chair Randolph and Board Members,

The California Air Resources Control Board's (CARB) Draft Fiscal Year (FY) 2021-22 Funding Plan for Clean Transportation Incentives advances California's climate and environmental goals by prioritizing significant investments in decarbonization, zero-emission technology introduction and deployment, and strategies to improve air quality for disadvantaged communities most impacted by pollution. The proposed investments in off-road applications are key to promoting the utilization of emission reducing technologies in support of the state's greenhouse gas, criteria pollutant, and toxic emissions reduction goals.

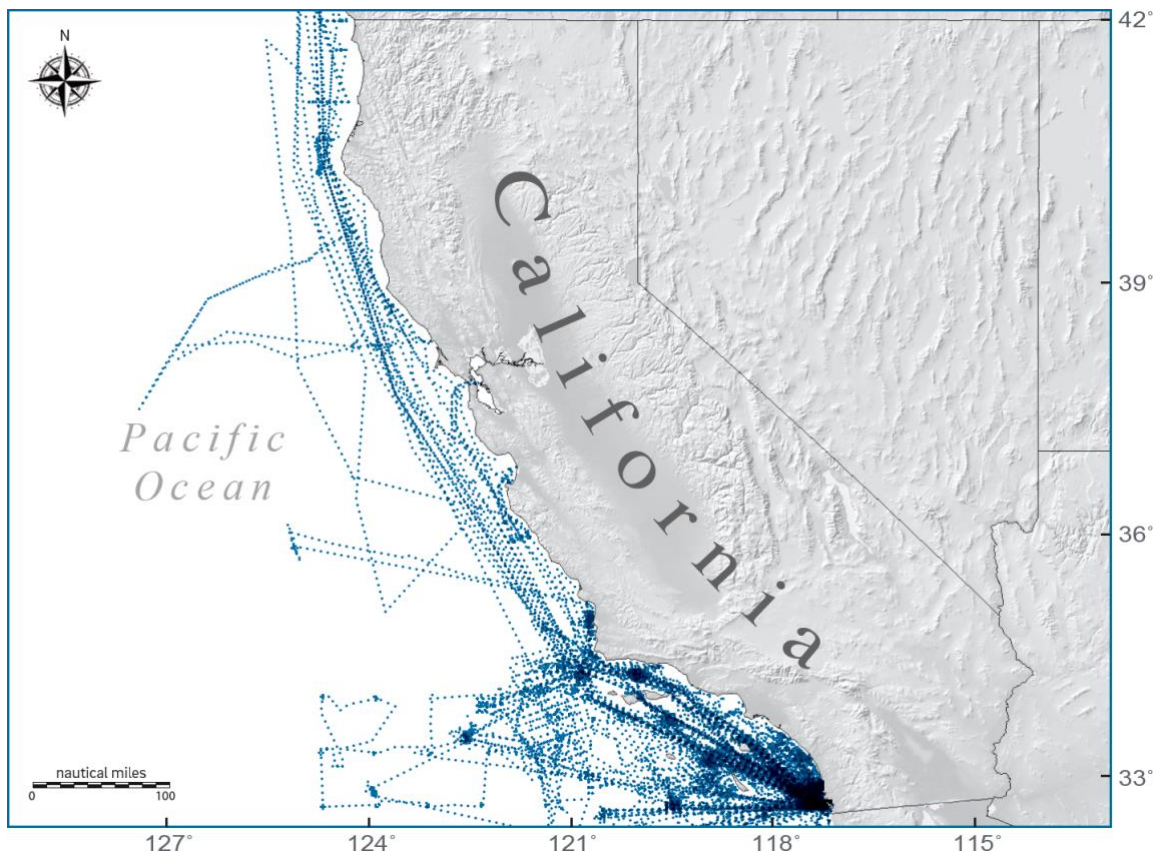
Please consider within the CARB FY 2021-22 Funding Plan fuel cell demonstration and pilot projects for Marine Harbor Craft, particularly the construction of new zero-emission and hydrogen-hybrid oceanographic research vessels for use in coastal research. Further, as the Board reviews amendments to the Carl Moyer Memorial Air Quality Standards Attainment Program 2017 Guidelines, we request including support for new zero-emission and hydrogen-hybrid marine vessel construction. Though engine repowering projects offer significant value, new construction provides an ideal opportunity to optimize vessel power systems for zero-emission operations and will provide a powerful incentive to use hydrogen rather than diesel power from the outset of a new vessel's service life. We request that size limits not be placed on eligible 46 CFR Subchapter U vessels, so hydrogen fuel cell technology may be accessed, deployed, and validated across a broad size range of oceanographic research vessels.

Oceangoing vessels operating nearshore and in port areas constitute a visible pollution source in close proximity to dense population areas where emissions have a disproportionate and adverse effect on human health. Bold and transformational action is urgently needed to improve the health of San Diego's Assembly Bill 617 Community of Portside Environmental Justice Neighborhoods (Portside Community) by reducing and eliminating emissions from port-related activities. Furthermore, the Port of San Diego's *Maritime Clean Air Strategy: Health Equity for All* sets ambitious clean air standards in support of healthy communities, a sustainable environment, and a thriving seaport.

Eliminating emissions and transitioning away from fossil fuels aboard oceangoing vessels is particularly challenging, because strategies that work well on land (battery electric vehicles) cannot provide the range or duration required for most vessels [Klebanoff et al., 2021], including coastal oceanographic research vessels.

Green hydrogen (produced using renewable energy sources such as wind or solar power, rather than from fossil fuels) enables a zero-CO₂ and zero-criteria pollutant energy pathway for oceangoing vessels. Propulsion systems powered by hydrogen fuel cells have been shown to be feasible using existing technology, and using green hydrogen can achieve emissions reductions that enable a zero-CO₂ and zero-criteria pollutant energy pathway for oceangoing vessels [Madsen et al, 2020; Klebanoff et al, 2018].

Oceanographic research vessels (as defined under 46 CFR Subchapter U) are ideal for hydrogen demonstration projects, and often work in nearshore areas and marine protected areas that would significantly benefit from zero-emission operations. They are also highly visible platforms due to their work carrying hundreds of scientists and students to sea annually from institutions all across California, and would serve as a powerful and enduring expression of the state's commitment to reducing pollution and greenhouse gas emissions.



Oceanographic research vessels have enabled research and education programs vital to California's economy and quality of life. The tracklines shown here represent efforts during the period 2011-2018 aboard the R/V Robert Gordon Sproul and R/V New Horizon, involving more than 4,400 researchers, students and instructors aboard 298 separate missions that used 1,123 operational days at sea along the length of California's coast [Scripps Institution of Oceanography data]. Emissions from these vessels have impacts on port and coastal communities, and reach far inland as well [Dabdub et al., 2008].

As the state seeks to expand California's hydrogen fuel infrastructure, we request CARB establish ways to defray the cost of green hydrogen used in maritime hydrogen fuel systems aboard seagoing vessels, so that the cost of operations of clean hydrogen vessels can be comparable with lower-cost diesel. Access to affordable green hydrogen will incentivize the expanded use of hydrogen fuel technology to the maritime industry, supporting state carbon reduction goals and enabling a zero-carbon well-to-wake energy pathway.

This project is responsive with San Diego's Community Emissions Reduction Plan (CERP), which contains detailed information and strategies intended to reduce both air pollution emissions and community exposure to air pollution in Portside Community neighborhoods surrounding San Diego Harbor. The recently approved plan noted that in the Portside Community, NOx emissions, a component of smog, are driven by off-road mobile sources, with the major contributors being ocean going vessels and harbor craft.

Thank you for your time and consideration.

Regards,

Bruce Appelgate

References cited

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Klebanoff, L.E., J.W. Pratt, R.T. Madsen, S.A.M. Caughlan, T.S. Leach, T. B. Appelgate Jr, S.Z. Kelety, H.-C. Wintervoll, G.P. Haugom, and A.T.Y. Teo. Feasibility of the Zero-V: A Zero-emission Hydrogen Fuel Cell, Coastal Research Vessel. No. SAND-2018-4664. Sandia National Lab.(SNL-CA), Livermore, CA (United States), 2018.

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Madsen, R.T., L.E. Klebanoff, S.A.M. Caughlan, J.W. Pruitt, T.S. Leach, T.B. Appelgate Jr., S.Z. Kelety, H.-C. Wintervoll, G.P. Haugom, A.T.Y. Teo, S. Ghosh, Feasibility of the Zero-V: A zero-emissions hydrogen fuel-cell coastal research vessel. Int. J. Hydrogen Energy. 45:25328-25343, 2020.

ATTACHMENT - Scripps Hydrogen-Hybrid Vessel Support Letters



September 20, 2021

Bruce Appelgate, PhD
Associate Director
Scripps Institution of Oceanography
University of California San Diego
9500 Gilman Drive
La Jolla, CA 92093

Subject: Letter of Support for Scripps Hydrogen-Hybrid Coastal Research Vessel Project

Dear Dr. Appelgate,

On behalf of Pacific Environment, I am pleased to submit this letter of support for funding for UC San Diego's Scripps Institution of Oceanography (Scripps) hydrogen-hybrid coastal research vessel project.

Ships are one of the worst air polluters in California, accounting for nearly 1% of the state's greenhouse gas pollution. California's air quality and climate crises continue to worsen and are exacerbated by the Port's freight activity, exacting a significant toll on the surrounding community. Harbor crafts and Ocean Going Vessels (OGVs) are the biggest emitter of NO_x, Diesel PM and CO_{2e} in the area surrounding Port of San Diego. We must take immediate and meaningful action now to more rapidly dismantle the roadblocks to a zero-emissions freight sector in San Diego and beyond.

Pacific Environment (PE) is a 501(c)(3) global public-benefit corporation, headquartered in San Francisco. We have permanent consultative status at the International Maritime Organization (IMO), the United Nations' entity that sets international shipping law. We played a lead role at the IMO in advocating for a new international regulatory regime (called the "Polar Code") to regulate ship traffic, pollutant emissions, and waste dumping in Arctic waters. We are co-founders and leaders of a burgeoning new global coalition of environmental, environmental justice, and ocean organizations working to rapidly accelerate the shipping industry's zero-emission transition on a 1.5C-aligned timeline.

This vessel will advance PE's efforts to reduce criteria pollutants and greenhouse gas emissions from ships, while demonstrating the viability of clean, nonpolluting zero-emission shipboard power systems to the maritime industry. The vessel will feature an innovative hybrid propulsion system that will use hydrogen fuel cells to enable true zero-emission operations for 75 percent of the ship's expeditions, supplemented by a conventional diesel-electric power plant when additional range is required offshore.

Bold and transformational solutions such as this are urgently needed to improve the health of the Portside Community by reducing and eliminating emissions from port-related activities. In areas

473 Pine Street, Third Floor • San Francisco, CA 94104

p. 415.399.8850 • www.pacificenvironment.org

surrounding the San Diego port, harbor craft constitute **one of the top three sources** of cancer risk because of diesel particulate matter exposure. The Scripps hydrogen-hybrid vessel demonstrates to the global maritime industry an operationally viable pathway for decarbonizing OGVs.

We are advocating for adoption of green hydrogen (hydrogen derived from low-carbon sources) for maritime hydrogen fuel systems at the state and federal level. PE supports measures to defray the cost of green hydrogen used on ships to effectively compete with lower-cost diesel fuel. Access to affordable green hydrogen will incentivize and accelerate the expanded use of hydrogen fuel technology within the maritime industry, supporting federal and state carbon reduction goals and enabling a zero-carbon well-to-wake energy pathway.

PE understands Scripps is in the early phase of project development. The following timeline provided by Scripps gives a high-level overview of forthcoming project milestones:

- 2021: Establishment of project office and kickoff
- 2022: Development of detailed vessel engineering and design
- 2023: Final engineering review and construction preparation
- 2024: Keel laying and construction
- 2025: Christening, sea trials, and delivery to Nimitz Marine Facility
- 2026: Commissioning and commencement of science operations

Once in San Diego, we understand the hydrogen-hybrid coastal research vessel will have significant localized benefits. Hydrogen fuel cell power enables zero emissions at the point-of-use, meaning this ship will not exhaust any criteria pollutants or CO₂ into San Diego's air. Unlike hydrocarbon fuels, hydrogen fuel poses no risk of oil spills -- if spilled, liquid hydrogen cleans itself up in less than 30 seconds and heads towards space at 30 knots as a nontoxic, non-greenhouse gas. Vessel operations involving hydrogen fuel cells are also much quieter than diesel engines, resulting in fewer noise impacts to port-adjacent neighborhoods.

By establishing this vessel in San Diego bay, we recognize that San Diego will be at the forefront of demonstrating to the global maritime community that clean, quiet, nonpolluting zero-emission OGVs are operationally feasible, which is an important first step in decarbonizing the maritime industry.

We believe that continued work by Scripps is innovative, cutting edge and extremely beneficial to the work that we undertake to transition ships off of fossil fuels. We appreciate the opportunity to express our support for the Scripps hydrogen-hybrid coastal research vessel and look forward to the opportunity to collaborate on this important project.

Sincerely,

Madeline Rose

Madeline Rose
Climate Campaign Director
Pacific Environment



September 8, 2021

Mr. Bruce Appelgate
Associate Director
Scripps Institution of Oceanography
University of California, San Diego
9500 Gilman Drive
La Jolla, CA 92093

Subject: Letter of Support for Scripps Hybrid-Hydrogen Coastal Research Vessel Project.

Dear Mr. Appelgate,

The San Diego Unified Port District (District) would like to express its support for the University of California, San Diego's Scripps Institution of Oceanography Hybrid-Hydrogen Coastal Research Vessel Project.

This project is in alignment with District efforts to reduce criteria pollutants and greenhouse gas emissions from diesel-powered ships, while demonstrating the viability of clean, nonpolluting shipboard power systems to the maritime industry. The vessel will sail from the Nimitz Marine Facility within San Diego Bay, and feature an innovative hybrid propulsion system that integrates hydrogen fuel cells alongside a conventional diesel-electric power plant, enabling zero-emission operations for 75 percent of its expeditions.

The advancement of maritime operations and environmental stewardship is central to the District's mission. The District is committed to fostering a vibrant and sustainable maritime economy that protects the health of port-side communities by reducing and eliminating emissions from port-related activities. The District's Maritime Clean Air Strategy: Health Equity for All sets ambitious clean air standards in support of healthy communities, a sustainable environment, and a thriving seaport. The Scripps hybrid-hydrogen vessel supports this critical effort by advancing the utilization of zero-emission technologies in commercial harbor craft, a key goal of the Port's Strategy.

I appreciate the opportunity to express support for the Scripps Hybrid-Hydrogen Coastal Research Vessel Project. If you have any questions, please contact Aimee Heim at 619-686-6390 or aheim@portofsandiego.org.

Sincerely,

A handwritten signature in blue ink, appearing to read "J. Stuyvesant", written over a light blue horizontal line.

J. Stuyvesant
President/CEO



October 20, 2021

Bruce Appelgate, PhD
Associate Director
Scripps Institution of Oceanography
University of California San Diego
9500 Gilman Drive
La Jolla, CA 92093

Subject: Letter of Support for Scripps Hydrogen-Hybrid Coastal Research Vessel Project.

Dear Dr. Appelgate,

The Portside Environmental Justice Steering Committee (Portside Committee) supports funding for UC San Diego's Scripps Institution of Oceanography (Scripps) hydrogen-hybrid coastal research vessel project. This vessel will advance the Portside Committee's efforts to reduce criteria pollutants and greenhouse gas emissions from ships, while demonstrating the viability of clean, nonpolluting zero-emission shipboard power systems to the maritime industry. The vessel will feature an innovative hybrid propulsion system that will use hydrogen fuel cells to enable true zero-emission operations for 75 percent of the ship's expeditions, supplemented by a conventional diesel-electric power plant when additional range is required offshore.

Bold and transformational solutions such as this are urgently needed to improve the health of the Portside Community by reducing and eliminating emissions from port-related activities. The Portside Committee led the development of the Community Emissions Reduction Plan (CERP), which contains detailed information and strategies intended to reduce community exposure to air pollution emissions. The recently approved CERP notes NOx emissions in the Portside Community are driven by off-road mobile sources, with the major contributors being ocean-going vessels and commercial harbor craft. The Scripps hydrogen-hybrid vessel supports CERP implementation by advancing the utilization of zero-emission technologies in port operations, while demonstrating to the global maritime industry an operationally viable pathway for decarbonizing ocean-going vessels.

As federal and state governments seek to expand access to hydrogen fuel infrastructure, the Portside Committee supports strategies to establish the broad availability and adoption of green hydrogen (hydrogen derived from low-carbon sources) for maritime hydrogen fuel systems. The Portside Committee supports measures to defray the cost of green hydrogen used on ships to effectively compete with lower-cost diesel fuel. Access to affordable green hydrogen will incentivize and accelerate the expanded use of hydrogen fuel technology within the maritime

industry, supporting federal and state carbon reduction goals and enabling a zero-carbon well-to-wake energy pathway. Scripps is committed to powering the research vessel with green hydrogen as soon as this clean fuel source is readily available to support ship operations.

The Portside Committee understands Scripps is in the early phase of project development. The following timeline provided by Scripps gives a high-level overview of forthcoming project milestones:

- 2021: Establishment of project office and kickoff
- 2022: Development of detailed vessel engineering and design
- 2023: Final engineering review and construction preparation
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Once in San Diego, we understand the hydrogen-hybrid coastal research vessel will have significant localized benefits. Hydrogen fuel cell power enables zero emissions at the point-of-use, meaning this ship will not exhaust any criteria pollutants or CO₂ into San Diego's air. Unlike hydrocarbon fuels, hydrogen fuel poses no risk of oil spills -- if spilled, liquid hydrogen cleans itself up in less than 30 seconds and heads towards space at 30 knots as a nontoxic, non-greenhouse gas. Vessel operations involving hydrogen fuel cells are also much quieter than diesel engines, resulting in fewer noise impacts to port-adjacent neighborhoods. By establishing this vessel in our bay, we recognize that San Diego will be at the forefront of demonstrating to the global maritime community that clean, quiet, nonpolluting zero-emission ocean-going vessels are operationally feasible, which is an important first step in decarbonizing the maritime industry.

The Portside Committee is committed to fostering a thriving and sustainable seaport that protects the health and wellbeing of Portside Community residents. We appreciate the opportunity to express our support for the Scripps hydrogen-hybrid coastal research vessel and look forward to the opportunity to collaborate on this important project.

Sincerely,

Portside Environmental Justice Steering Committee

Cc: Domingo Vigil, San Diego County Air Pollution Control District
Larry Hofreiter, Port of San Diego